WHAT IS CLAIMED IS:

1. A method for analyzing optical properties of optical signals comprising:

receiving an input optical signal having input spectral peaks at different frequencies;

providing a local optical signal having a central spectral peak and a side spectral peak; and

combining and mixing said input optical signal and said local optical signal to construct output spectral peaks that include combinations of said input spectral peaks of said input optical signal.

2. The method of claim 1 further comprising deriving spectral phase differences between said input spectral peaks of said input optical signal using said output spectral peaks.

3. The method of claim 2 wherein said providing of said local optical signal includes optically modulating a local oscillator signal with respect to one of intensity and phase to produce said local optical signal.

4. The method of claim 3 wherein said optically modulating of said local oscillator signal includes optically modulating said local oscillator signal such that the frequency separation between said central spectral peak and said side spectral peak is approximately equal to an integer times half of the frequency separation of said input spectral peaks of said input optical signal.

5. The method of claim 4 wherein said optically modulating of said local oscillator signal includes shifting the phase of an electrical modulation signal used to phase modulate said local oscillator signal such that amplitudes of said output spectral peaks are changed.

6. The method of claim 5 wherein said deriving of said spectral phase differences includes computing said spectral phase differences between said input spectral peaks of said input optical signal using said output spectral peaks produced by said shifting of said phase of said electrical modulation signal.

7. The method of claim 4 wherein said optically modulating of said local oscillator signal includes modulating the phase of an electrical signal used to phase modulate said local oscillator signal.

8. The method of claim 7 wherein said deriving of said spectral phase differences includes measuring amplitudes of different harmonics of the frequency of said electrical signal.

9. The method of claim 8 wherein said deriving of said spectral phase differences computing said spectral phase differences between said input spectral peaks of said input optical signal using said amplitudes of even and odd harmonics of said frequency of said electrical signal.

10. The method of claim 3 wherein said optically modulating of said local oscillator signal includes optically modulating said local oscillator signal such that the frequency separation between said central spectral peak and said side spectral peak is equal to an integer times half of the frequency separation of said input spectral peaks of said input optical signal offset by a reference frequency.

11. The method of claim 10 wherein said deriving of said phase differences includes comparing said output spectral peaks with a reference signal having said reference frequency to measure said spectral phase differences of said input spectral peaks of said input optical signal.

12. An optical analyzer system comprising:

an input to receive an input optical signal having input spectral peaks at different frequencies;

an optical signal generator configured to generate a local optical signal having a central spectral peak and a side spectral peak;

an optical coupler configured to combine said input optical signal and said local optical signal; and

an optical receiver configured to receive and mix said input optical signal and said local optical signal to construct output spectral peaks that include combinations of said input spectral peaks of said input optical signal.

13. The system of claim 12 further comprising a processing unit operatively connected to said optical receiver, said processing unit being configured to derive spectral phase differences between said input spectral peaks of said input optical signals using said output spectral peaks.

14. The system of claim 13 wherein said optical signal generator includes an optical local oscillator source to generate a local oscillator signal and an optical modulator to modulate said local oscillator optical signal, said optical modulator including one of an intensity modulator and a phase modulator.

15. The system of claim 14 wherein said phase modulator is configured to optically modulate said local oscillator signal such that the frequency separation between said central spectral peak and said side spectral peak is approximately equal to an integer times half of the frequency separation of said input spectral peaks of said input optical signal.

16. The system of claim 15 wherein said optical signal generator includes a modulation controller operatively connected to said phase modulator, said modulation controller being configured to shift the phase of an electrical modulation signal applied to said phase modulator to phase modulate said local oscillator signal such that amplitudes of said output spectral peaks are changed.

17. The system of claim 16 wherein said processing unit includes a computer that is configured to compute said spectral phase differences between said input spectral peaks of said input optical signal using said output spectral peaks produced by a shift of said phase of said electrical modulation signal.

18. The system of claim 14 wherein said optical signal generator includes a modulation controller operatively connected to said phase modulator, said modulation controller being configured to modulate the phase of an electrical signal applied to said phase modulator to phase modulate said local oscillator signal.

19. The system of claim 18 wherein said processing unit includes a phase sensitive detector to measure amplitudes of different harmonics of the frequency of said electrical signal.

20. The system of claim 19 wherein said processing unit further includes a processor operatively connected to said phase sensitive detector, said processor being configured to compute said spectral phase differences between said input spectral peaks of said input optical signal using said amplitudes of even and odd harmonics of said frequency of said electrical signal.

21. The system of 14 wherein said phase modulator is configured to optical modulate said local oscillator signal such that the frequency separation between said central spectral peak and said side spectral peak is equal to an integer times half of the frequency separation of said input spectral peaks of said input optical signal offset by a reference frequency.

22. The system of claim 21 wherein said processing unit includes a phase sensitive detector to compare said output spectral peaks with a reference signal having said reference frequency to measure said spectral phase differences of said input spectral peaks of said input optical signal.

23. A method for analyzing optical properties of optical signals comprising: receiving an input optical signal having input spectral peaks at different frequencies; providing a local oscillator signal; combining and mixing said input optical signal and said local oscillator optical signal to produce a heterodyne signal; and electrically mixing said heterodyne signal with an electrical signal to produce a mixed electrical signal having output spectral peaks that include combinations of said input spectral peaks of said input optical signal.

24. The method of claim 23 further comprising comparing said mixed electrical signal with a reference signal to measure spectral phase differences between said input spectral peaks of said input optical signal.

25. The method of claim 23 further comprising reconstructing said input spectral peaks of said input optical signal from said output spectral peaks.

26. The method of claim 23 wherein said reference signal has a frequency defined by a frequency separation of said input spectral peaks of said input optical signal and the frequency of said electrical signal.

27. An optical analyzer system comprising: an input to receive an input optical signal having input spectral peaks at different frequencies; a local oscillator configured to generate a local oscillator signal; an optical coupler configured to combine said input optical signal and said local oscillator optical signal; an optical receiver configured to receive and mix said input optical signal and said local oscillator optical signal to produce a heterodyne signal; and a mixer configured to mix said heterodyne signal with an electrical signal to produce a mixed electrical signal having output spectral peaks that include combinations of said input spectral peaks of said input optical signal.

28. The system of claim 27 further comprising a phase sensitive detector configured to compare said mixed electrical signal with a reference signal to measure phase differences between said spectral peaks of said input optical signal.

29. The system of claim 27 further comprising a calculator that is configured to reconstruct said input spectral peaks of said input optical signal from said output spectral peaks of said mixed electrical signal.

30. The system of claim 27 wherein said reference signal has a frequency defined by a frequency separation of said input spectral peaks of said input optical signal and the frequency of said electrical signal.